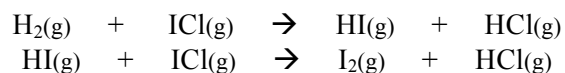


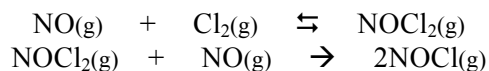
Reaction Mechanism Worksheets

1. The following mechanism has been proposed for the gas-phase reaction of H_2 with ICl :



- (a) Write the balanced equation for the reaction.
- (b) Identify any intermediates in the mechanism.
- (c) Write the rate laws for each elementary reaction as well as their molecularity for each step in the mechanism.
- (d) If the first step is slow and the second one is fast, what rate law do you expect to be observed for the overall reaction?
- (e) Sketch an energy diagram outlining each step in the reaction.

2. The reaction $2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{NOCl}(\text{g})$ obeys the rate law, $\text{Rate} = k[\text{NO}]^2[\text{Cl}_2]$. The following mechanism has been proposed for this reaction:

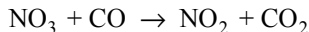


- (a) Write the rate law for each elementary step.
- (b) What would be the rate law be if the first step were rate determining? Does this match the rate law?
- (c) What can you conclude about the relative rates of the two steps?
- (d) Write the rate laws for the reverse reactions of each elementary step.
- (e) Using these reactions derive the rate law for the overall reaction.

3. The overall reactions and rate laws for several reactions are given below. Of these, only _____ could represent an elementary step.

- | | |
|------------------------------|------------------|
| A) $2A \rightarrow P$ | rate = $k[A]$ |
| B) $A + B \rightarrow P$ | rate = $k[A][B]$ |
| C) $A + 2B \rightarrow P$ | rate = $k[A]^2$ |
| D) $A + B + C \rightarrow P$ | rate = $k[A][C]$ |
| E) $A + 2B \rightarrow P$ | rate = $k[A][B]$ |

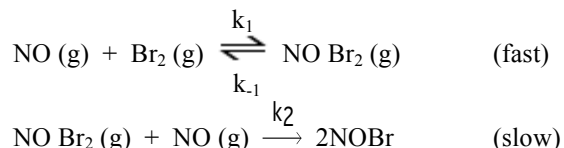
4. For the elementary reaction



the molecularity of the reaction is _____, and the rate law is rate = _____.

- A) 2, $k[\text{NO}_3][\text{CO}]$
 B) 4, $k[\text{NO}_3][\text{CO}][\text{NO}_2][\text{CO}_2]$
 C) 2, $k[\text{NO}_2][\text{CO}_2]$
 D) 2, $k[\text{NO}_3][\text{CO}]/[\text{NO}_2][\text{CO}_2]$
 E) 4, $k[\text{NO}_2][\text{CO}_2]/[\text{NO}_3][\text{CO}]$

5. A possible mechanism for the overall reaction, $\text{Br}_2 (\text{g}) + 2\text{NO} (\text{g}) \rightarrow 2\text{NOBr} (\text{g})$ is



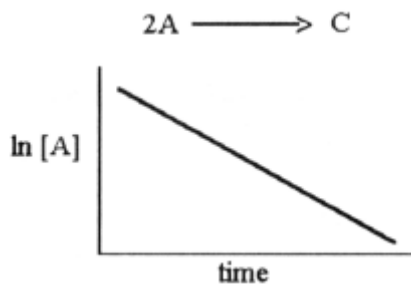
The rate law for formation of NOBr based on this mechanism is rate = _____.

- A) $k_1[\text{NO}]^{1/2}$
 B) $k_1[\text{Br}_2]^{1/2}$
 C) $(k_2k_1/k_{-1})[\text{NO}]^2[\text{Br}_2]$
 D) $(k_1/k_{-1})[\text{NO}]^2$
 E) $(k_2k_1/k_{-1})[\text{NO}]^2[\text{Br}_2]$

6. The rate law of the overall reaction $A + B \rightarrow C$ is rate = $k[A]^2$. Which of the following will not increase the rate of the reaction?

- A) increasing the concentration of reactant A
 B) increasing the concentration of reactant B
 C) increasing the temperature of the reaction
 D) adding a catalyst for the reaction
 E) All of these will increase the rate.

7. The graph shown below depicts the relationship between concentration and time for the following chemical reaction.



The slope of this line is equal to _____.

- A) k
 B) $-1/k$
 C) $\ln[A]_0$
 D) $-k$
 E) $1/k$